WHAT EVERY PILOT SHOULD KNOW ABOUT

O_2xygen

ZODIAC

AVOX Systems

What Is Air?

The air surrounding us is a mixture of gases consisting of 78% nitrogen and 21% oxygen. The remaining 1% is made up of argon, carbon dioxide, and traces of rare gases.

What Is Oxygen?

Under normal conditions, pure oxygen is a colorless, tasteless, odorless, non-combustible gas. It is the most important single element in our universe.

Why Is Oxygen So Important?

Although it will not burn alone, oxygen supports combustion; in fact, without oxygen there can be no fire. Oxygen, therefore, is not only necessary for the burning of combustible materials, but it is also absolutely essential to support the process of "vital combustion" which maintains human life. Although a person can live for weeks without food or for days without water, he or she dies in minutes if deprived of oxygen.

The human body is essentially a converter which consumes fuel and produces heat and energy. It is like a furnace which utilizes the oxygen in the air to burn coal, thus producing heat and power. The human body must have oxygen to convert fuel (the carbohydrates, fats, and proteins in our diet) into heat, energy, and life. The conversion of body fuels into life is similar to the process of combustion; fuel and oxygen are consumed, while heat and energy are generated. This process is known as "metabolism."

Where And How Do We Normally Obtain Our Oxygen?

At each breath we fill our lungs with air containing 21% oxygen. Millions of tiny air sacs (known as "alveoli") in our lungs inflate like tiny balloons. In the minutely thin walls enclosing each sac are microscopic capillaries, through which blood is constantly transporting oxygen from the lungs to every cell in the body. Because the body has no way to store oxygen, it leads a breath-to-breath existence.

How Much Oxygen Does The Human Body Need?

The rate of metabolism, which determines the need for and consumption of oxygen, depends on the degree of physical activity or mental stress of the individual. A person walking at a brisk pace will consume about four times as much oxygen as he or she would when sitting quietly. Under severe exertion or stress, he or she could be consuming eight times as much oxygen as when resting.

What Happens If The Body Does Not Receive Enough Oxygen?

When the body is deprived of an adequate oxygen supply, even for a short period, various organs and processes in the body begin to suffer impairment from oxygen deficiency. This condition is known as "hypoxia." Hypoxia affects every cell in the body, but especially the brain and the body's nervous system. This makes hypoxia extremely insidious, difficult to recognize, and a serious hazard especially for flight personnel.

What Are The Effects Of Hypoxia?

Hypoxia causes impairment of vision (especially at night), lassitude, drowsiness, fatigue, headache, euphoria (a false sense of exhilaration), and temporary psychological disturbance. These effects do not necessarily occur in the same sequence nor to the same extent in all individuals, but are typical in average persons who are affected by hypoxia.

When And Why Must We Use Extra Oxygen?

Supplementary oxygen must be used to enrich the air we breathe to compensate for either a deficiency on the part of the individual or a deficiency in the atmosphere in which we are breathing.

A person may have a respiratory or circulatory impairment which reduces the ability of the body to utilize the 21% oxygen in the air. For such a person, supplementary oxygen must be administered by an oxygen tent or by oxygen mask to enrich the inhaled air. The total volume of oxygen in each inhalation is then so much greater than normal that it compensates for the individual's own physical inability to utilize normal atmospheric oxygen.

When we ascend in altitude, a different condition is encountered: a condition in which the individual may be perfectly normal, but in which there is an oxygen deficiency in the atmosphere and supplementary oxygen must therefore be used.

Does The Percentage Of Oxygen In The Air Change With Altitude?

No, the ratio of oxygen to nitrogen in the composition of air does not change. The 21% of oxygen in the air remains relatively constant at altitudes up to one hundred thousand feet.

Why Must We Use Extra Oxygen When We Ascend In Altitude?

The blanket of air which surrounds our planet is several hundred miles thick, compressible, and has weight. The air closest to the earth is supporting the weight of the air above it and, therefore, is more dense; its molecules are packed closer together. As we ascend in altitude, the air is less dense. For example, at 10,000 feet, the atmospheric pressure is only two-thirds of that at ground level. Consequently, the air is less dense, and each lungful of air contains only two-thirds as many molecules of oxygen as it did at ground level. At 18,000 feet the atmospheric pressure is only one-half of that at ground level. Although the percentage of oxygen is still the same as at ground level, the number of molecules of oxygen in each lungful is reduced by one-half.

As we ascend, there is a progressive reduction in the amount of oxygen taken into the lungs with each breath, and a corresponding decrease in the amount of oxygen available for the bloodstream to pick up and transport to every cell in the body. To compensate for this progressive oxygen deficiency, we must add pure oxygen to the air we breathe in order to maintain enough oxygen molecules to supply the metabolic needs of the body.

At What Altitudes Should Oxygen Be Used?

In general, it can be assumed that the normal, healthy individual is unlikely to need supplementary oxygen at altitudes below 8,000 feet. One exception is night flying. Because the retina of the eye is affected by even extremely mild hypoxia, deterioration of night vision becomes significant above 5,000 feet.

Between 8,000 and 12,000 feet, hypoxia may cause the first signs of fatigue, drowsiness, sluggishness, headache, and slower reaction time. At 15,000 feet, the hypoxic effect becomes increasingly apparent in terms of impaired efficiency, increased drowsiness, errors in judgment, and difficulty with simple tasks requiring mental alertness or muscular coordination. These symptoms become more intensified with progressively higher ascent or with prolonged exposure. At 20,000 feet, a pilot may scarcely be able to see – much less read – the instruments. His or her hearing, perception, judgment, comprehension, and general mental and physical faculties are practically useless. The pilot may be on the verge of complete collapse.

Therefore, the availability and use of supplemental oxygen is recommended on night flights where altitudes above 5,000 feet are contemplated, and for altitudes above 8,000 feet on daytime flights.

How Can You Tell When You Need Oxygen?

You can't; therefore, oxygen should be used before it is needed. The most dangerous aspect of hypoxia is the insidious, "sneaky" nature of its onset. Because the effects of hypoxia are primarily on the brain and nervous system, there is a gradual loss of mental faculties, impairment of judgment, coordination, and skill; but these changes are so slow that they are completely unnoticed by the individual who is being affected. Actually, a person suffering from mild or moderate hypoxia is apt to feel a sense of exhilaration or security, and may be quite proud of his or her proficiency and performance although he or she may be on the verge of complete incompetence.

Because hypoxia acts upon the brain and nervous system, its effects are very much like those of alcohol or of other drugs which produce a false sense of well-being. There is a complete loss of ability for self-criticism or self-analysis. Some people believe that an individual can detect his or her need for oxygen by noting an increase in breathing rate, an accelerated heartbeat, and a slight bluish discoloration (cyanosis) of the fingernails. However, by the time these symptoms develop, the individual is more likely to be mentally incapable of recognizing these signs. The person may even decide that he or she has always wanted blue fingernails! Even while "spiraling" out of control, the individual may be convinced (if conscious at all) that he or she is doing this deliberately and enjoying it immensely.

Are All Individuals Equally Affected By Hypoxia?

No, they are not. Just as there is a variation among individuals in their ability to tolerate heat, cold, or alcohol, some people can tolerate without apparent effect a degree of hypoxia which would have noticeable effects on others who are more susceptible to the lack of oxygen. There is no way to measure and predict hypoxia tolerance because it can be affected by physical condition, fatigue, emotion, tobacco, alcohol, drugs, diet and other factors.

The individual who has flown at 14,000, 16,000, or 18,000 feet without oxygen and survived has no idea how close he or she may have been to disaster. The person may believe that all this talk about oxygen need, if true at all, does not apply to him or her. Such a belief may some day be fatal.

Is It True That Oxygen Is Toxic Or Harmful?

Oxygen therapy is often used for prolonged periods in hospitals and homes not with harmful, but definitely beneficial effects. It is most generally agreed that a 60% oxygen concentration on the ground, which is equivalent to a 100% oxygen concentration at approximately 12,000 feet, will not cause any harmful effects.

Why Not Use Oxygen Intermittently For Short Periods?

If one is at an altitude where there is an oxygen deficiency, intermittent use of oxygen would only temporarily alleviate the hypoxic effects during the period in which oxygen is being used. Because of the insidious nature of hypoxia, a person already mildly hypoxic is very unlikely to even think of using oxygen equipment, either intermittently or otherwise.

It is true that occasional use of oxygen for five or ten minutes (even at altitudes below 8,000 feet) can act as a "refresher" to relieve the effects of mild hypoxia, cigarette smoke, apprehension, or other factors. Also, the use of oxygen for five or ten minutes before the termination of a flight (even though the entire flight may have been at less than 8,000 feet) can be an excellent tonic to put the pilot in his or her best mental and physical condition for the approach procedures and landing maneuvers.

How Will Oxygen Equipment Improve The Utility Of The Airplane?

With oxygen equipment aboard, the pilot can choose the higher altitudes which give the smoothest flight, the most favorable winds, the best performance from the Omni and other radio navigation equipment, the highest speed, the longest range, and the best engine performance. The pilot can have these advantages safely with oxygen because his or her own performance will not be affected by hypoxia; he or she will be just as efficient and capable as at lower altitudes or even on the ground. With oxygen equipment in use, pilot and passengers will arrive at their destination fresh and fit, without the headache, lassitude, and fatigue which often result from prolonged exposure to even mild hypoxia.

What Types Of Oxygen Equipment Are Available For Private And Executive Aircraft?

There are a variety of types, including portable units which can be carried along when flight at hypoxic altitudes is anticipated. If flights at such altitudes are frequent, then a "built-in" oxygen system offers advantages, especially in the larger aircraft.

For either portable or built-in systems there is a choice between "demand" type and "continuous flow" type equipment. Demand type equipment delivers oxygen to the user's mask during each inhalation in response to his or her own breathing pattern, or "demand." The continuous flow type system delivers oxygen at a fixed rate to an accumulator bag which is attached to the mask, and from which the user inhales each breath.

How Should An Oxygen System Or Equipment Be Selected?

Your local dealer, with our help, can assist the pilot in selecting the one best suited to the specific airplane and your special needs.

WARNING

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